Space Weather Technical Forecast

Issued on Wednesday, 28 September 2022 at 13:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: G1-G2/Minor-Moderate geomagnetic storms likely to develop from late day 2 (29 Sept) or day 3 (30 Sept) with a chance of G3/Strong. Chance of R1/Minor Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low with several C-class flares observed, mostly from AR3107 and AR3105. The peak flare was a C5.1 at 27/1957 UTC from AR3105. This is one of four numbered active regions region now on the visible disc. Three regions are of moderate longitudinal extent. AR3110 in the northeast quadrant is a relatively simple bipolar region with a now large size single lead spot, with further slight decay in its weak trailer portion though otherwise shows little change. AR3107 in the southwest quadrant remains the longest region though continues to show some minor overall decay, the small delta spot in its intermediate spot portion looks to have separated and it is now classified as a beta-gamma . AR3105, also in the southwest, continues to be show slight decay, reducing slowly in size. AR3108 has now faded from view. Recently numbered AR3111 near the northeast limb remains a single Hax/Alpha type and shows little development.
Possible Earth-directed CME was observed 28/0400 UTC from a filament lift off to the east of AR3110, though analysis has not yet been performed due to lack of data.

Solar Wind / Geomagnetic Activity: Solar wind parameters have indicated a combination of HSS (CH26/-) and CME influences, with the latter appearing to be now waning.
The solar wind speed, as measured by DSCOVR at L1, rose from 500km/s to a peak of around 600km/s at 27/1530 UTC before reducing slowly back to around 550km/s. The density has remained at average to above average levels throughout. The total Interplanetary magnetic field strength, Bt, had reduced to strong levels by 27/1200 UTC with a peak value during the last 24hr period of 17nT at 27/1230 UTC, with a further steady decline back to weak levels. The north-south component, Bz, followed a similar trend but has stayed largely positive, with fluctuations between +15/-7nT. The phi angle has stayed generally negative (towards from the sun)).
Geomagnetic activity has been Quiet to Active (Kp 2 to 4) through the period.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, remained very slightly raised above normal background levels, but well below S1 levels. High energy electron flux (greater than 2 MeV) was predominantly at background levels, with a brief peak reaching 215 pfu at 27/1705 UTC. The associated 24-hour fluence remained below the Active (1e8 integrated pfu) threshold, with a sharp drop through the day from an initial reading of 6.18e7 integrated pfu at 27/1200UTC. Observed fluence at 28/0000UTC was 1.19e6 integrated pfu.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be generally Low, with a chance of isolated M-class flares, primarily from AR3107 and AR3105.

Solar Wind / Geomagnetic Activity: Solar wind speeds are currently elevated due to waning coronal hole influence from CH26/- and earlier transient CME effects. Solar winds speeds are expected to reduce back to slightly elevated levels by early day 2 (29th) though we may see temporary slight increases.

A HSS from CH27/+ expected to arrive from late day 2 (29th) or perhaps early day 3 (30th), with the following HSS associated with CH28/+ likely into day 3 (30th) and continue through the weekend UTC.

Geomagnetic activity is likely to be mostly Quiet to Unsettled, but with isolated Active intervals still possible into the first half of day 2 (29th). From late day 2 (29th) onward, G1/G2/Minor to Moderate storm intervals expected to develop, with a chance of G3/Strong storms.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to persist at background levels, with a slight chance of reaching S1 (or greater), most likely from AR3107 and AR3105. The high energy (greater than 2MeV) electron flux will likely remain at mostly background initially, perhaps rising to moderate or high levels later in the period. The associated 24 hour fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, but with an upward trend probable toward the end of the period.

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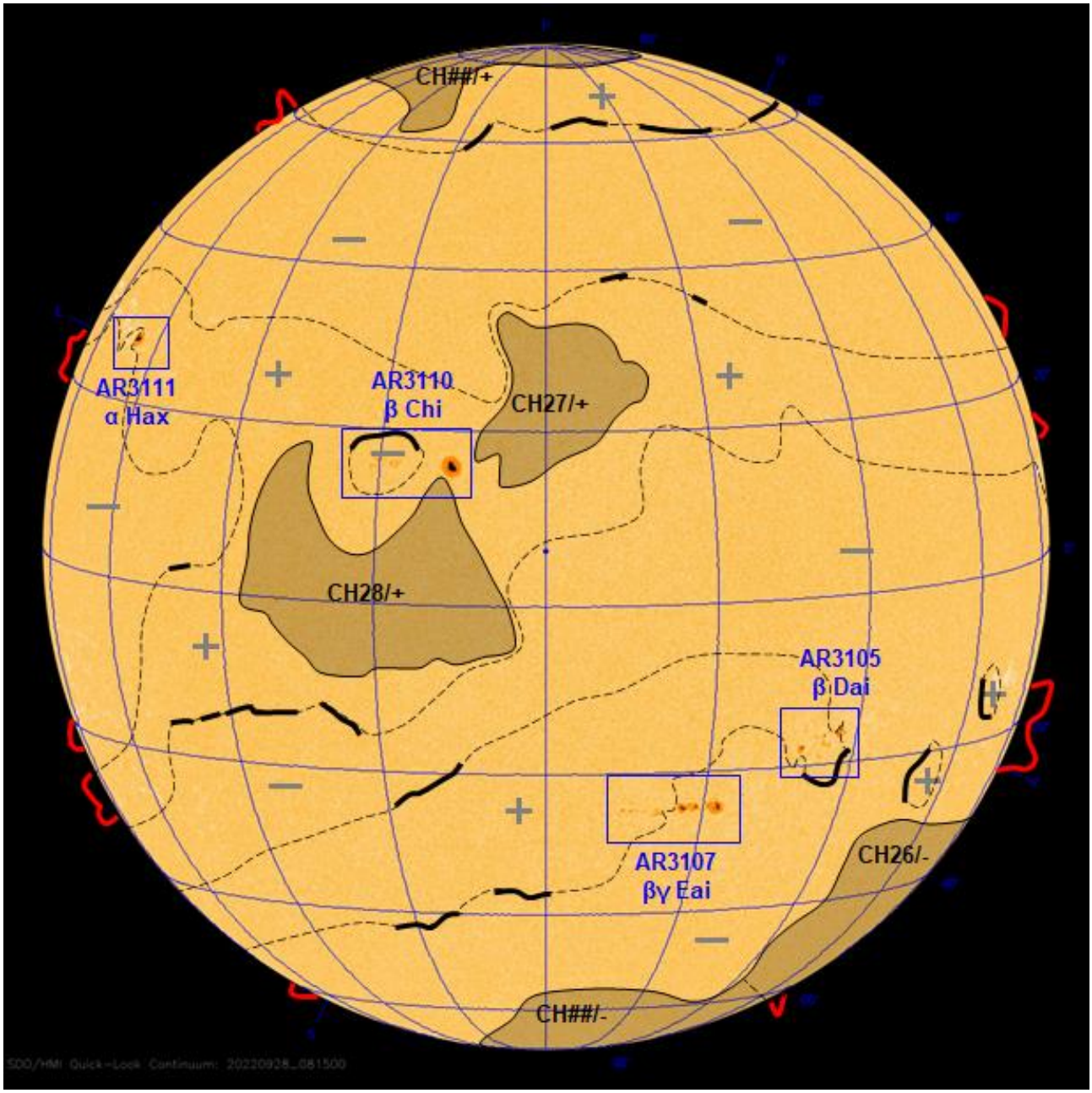
Figure 1. Solar Analysis Valid 28/0800.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar wind speeds are currently elevated due to waning coronal hole influence from CH26/- and earlier transient CME effects. Solar winds speeds are expected to reduce back to slightly elevated levels by early day 2 (29th) though we may see temporary slight increases.
A HSS from CH27/+ is then expected to arrive from late day 2 (29th) or perhaps early day 3 (30th), with the following HSS associated with CH28/+ likely into day 3 (30th) and continue through the weekend UTC. Last rotation these CH areas gave strong solar wind speeds peaking at or just above 700 km/s, and a brief G3/Strong storm interval near the onset. A similar forecast for this rotation is expected, with present imagery comparing favourably with 27 days ago and the positive nature of the HHS.
Geomagnetic activity is likely to be mostly Quiet to Unsettled, but with isolated Active intervals still possible into the first half of day 2 (29th). From from late day 2 (29th) onward, G1/G2/Minor to Moderate storm intervals expected to develop, with a chance of G3/Strong storms.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	40	80	70
Strong	G3	No	1	10	50	40
Severe	G4	No	1	1	10	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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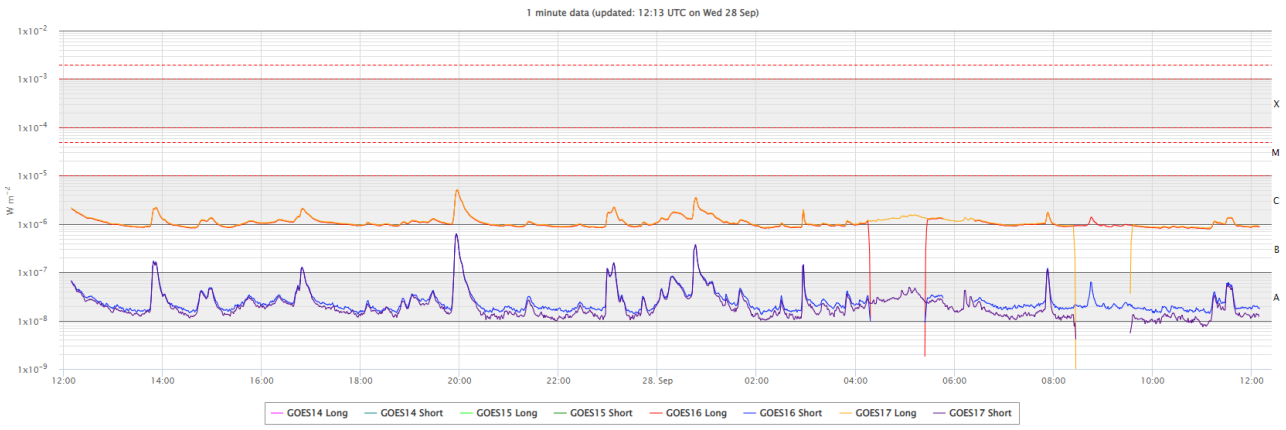
Radio Blackouts - X-Ray Flares:
Solar activity has been Low with occasional C-class flares, mainly from AR3107 and AR3105. Generally Low levels of activity are forecast to continue, but with a chance of isolated M-class flares, most likely from the spot groups already mentioned.

There are currently four numbered active regions on the visible disc. Three regions are of moderate longitudinal extent. AR3110 in the northeast quadrant is a relatively simple bipolar region with a now large size single lead spot, with further slight decay in its weak trailer portion though otherwise shows little change. AR3107 in the southwest quadrant remains the longest region though continues to show some minor overall decay, the small delta spot in its intermediate spot portion looks to have separated and it is now classified as a beta-gamma . AR3105, also in the southwest, continues to be show slight decay, reducing slowly in size. AR3108 has now faded from view. Recently numbered AR3111 near the northeast limb remains a single Hax/Alpha type and shows little development.

There two main potential returning regions that are due to reach the east limb during the period, with an potential active area currently forecast to move onto the visible disk into day 3.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	25	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: latest X Ray flux plot showing generally low activity.



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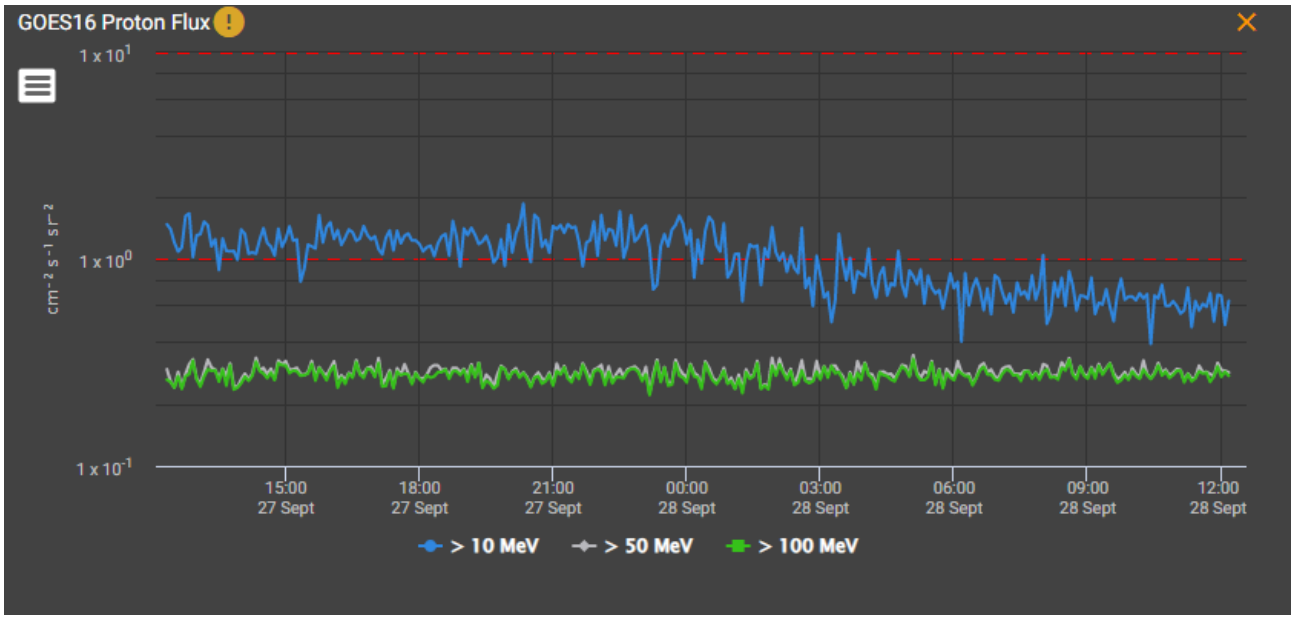
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10MeV) as observed by GOES16 has been at background levels, although very slightly elevated. Background levels are expected to continue, with a slight chance of S1 (or greater) radiation storms, mainly from the presence of AR3105 and AR3107 in the southwest quadrant.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 3: Latest Proton Flux.



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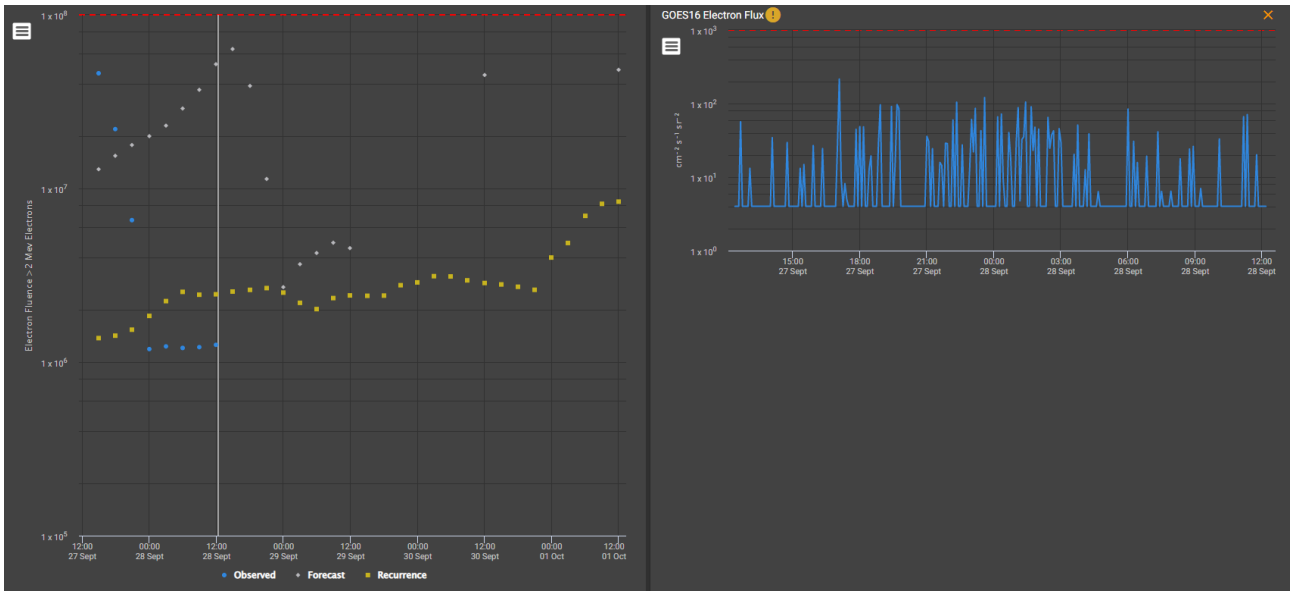
High Energy Electrons Event (≥ 2MeV):
The high energy (greater than 2MeV) electron flux, as observed by GOES-16 has been largely at background levels following the increased geomagnetic activity associated with HSS and CME influences, which have allowed electron populations in the Van Allen belts to be re-distributed. The next significant rise is anticipated to be once the HSS from CH27/+ and CH28/+ become established likely later day 2 (29th) or early day 3 (30th).
The associated electron 24 hour fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, but with a likely rising toward the end of the period. REFM is currently considered to be giving poor short term trend guidance, though longer term trends are considered more likely, these probably staying below Active fluence.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	20	30	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Latest Fluence and REFM model, as well as reported Flux



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